

Continuity of dairy cattle farming after the Foot-And-Mouth Disease outbreak in Boyolali Regency, Central Java Province

Endang Tri Rahayu*, Sutrisno Hadi Purnomo, Shanti Emawati, and Ratih Dewanti, Sastiya Dwitasari

Department of Animal Science, Faculty of Animal Science, Sebelas Maret University, Surakarta, Central Java, Indonesia

Abstract. The purpose of this study was to determine the characteristics of farmers and analyze the factors that influence the continuity of dairy cattle farming after foot-and-mouth disease (FMD) in Mojosongo District, Boyolali Regency. The research design used a quantitative descriptive method. The location and sample selection used a *purposive sampling* method, with a sample of 60 dairy cattle farmers. Data analysis in this study used descriptive analysis, instrument testing with validity and reliability tests, and multiple linear regression analysis. The results of the instrument test showed that it was valid and reliable. The results of the multiple linear regression equation were $Y = 4.741 - 0.070X_1 + 0.348X_2 + 0.284X_3 + 0.060X_4 - 0.044X_5 + e$. The F-test results showed that the $f_{(calculated)}$ value was greater than $f_{(table)}$, with a value of $5.917 > 2.386$, indicating that all independent variables together affect the continuity of dairy farming. The results of the t-test show that the variable that influences continuity of dairy farming is the need for security (X_2) with a $t_{(calculated)}$ value $> t_{(table)}$, while physiological needs, social needs, the need for recognition, and the need for self-actualization do not affect continuity of dairy cattle farming. The R^2 test result is 0.354. The conclusion is that only the security needs variable affects the continuity of dairy cattle farming after FMD.

1 Introduction

The development of the livestock sector is very important to meet public demand for livestock products, especially animal-based food products. Animal products such as milk from dairy cows are in high demand because they are rich in protein, energy, vitamins, and minerals that are beneficial to health. The development of the livestock sector, especially dairy cows, aims to increase milk production towards self-sufficiency, expand employment opportunities, and increase farmers' income [1].

*Corresponding author: Endangtri72@staff.uns.ac.id

Boyolali Regency is one of the areas in Central Java that has great potential for dairy cattle development. Based on statistical data, in 2024 the dairy cattle population in Boyolali Regency reached 54.684 heads [2]. Mojosongo District is one of the areas known as a producer of dairy milk in Boyolali Regency. The dairy cattle population in Mojosongo District in 2024 reached 10.005 heads [2]. This area is supported by geographical conditions and the availability of feed that supports dairy cattle productivity. In addition, Mojosongo District is also known as the main supplier of fresh milk to various cooperatives and milk processing industries in Boyolali Regency.

Dairy farmers have faced a major challenge in recent years, namely the outbreak of Foot and Mouth Disease (FMD) in several regions in Indonesia, particularly in Mojosongo District, Boyolali Regency. The FMD outbreak is a serious concern because it directly affects the economic conditions of farmers, especially in terms of the profitability of dairy farming. The impact of the outbreak has been felt by farmers in Mojosongo District, which is one of the centers of dairy farming in Boyolali Regency, where the outbreak has not only affected production, distribution, and trade, but also had an impact on the socio-economic activities of the community [3].

Foot-and-mouth disease (FMD) has increased again after a decline in the number of cases in livestock, especially beef cattle and dairy cattle. Cases of cattle deaths due to FMD have also been found in Boyolali. In January 2025, 17 cows were found dead, and these cases were spread across 10 subdistricts in Boyolali. The presence of FMD cases has caused many farmers to suffer losses, resulting in a decline in income for farmers. The presence of FMD cases has caused farmers to hesitate to continue their livestock businesses. The motivation of each individual can basically be influenced by intrinsic and extrinsic factors, such as physiological needs, security needs, social needs, need of recognition, and self-actualization needs.

Motivation is the force that influences farmers to achieve their goals in raising livestock. Motivation is a crucial element in achieving business success, which can increase family income. Farmers with high motivation are expected to increase beef cattle productivity and improve family welfare. Farmers with low motivation will be slow to change their behavior, causing an attitude of insincerity, which will result in a decline in business productivity. Based on this background, it is necessary to conduct research on the continuity of dairy cattle farming after FMD in Mojosongo District, Boyolali Regency.

2 Materials and Methods

This study was conducted in Mojosongo District, Boyolali Regency, Central Java, from June to July 2025. The research design was quantitative descriptive. The research location was determined *purposively*, namely in Mojosongo District, Boyolali Regency, Central Java. Based on statistical data, in 2024 the population of dairy cattle in Mojosongo District reached 10.005 heads [2]. This area also has a population of smallholder dairy farmers who are still actively running their businesses after FMD. The respondents in this study consisted of 60 dairy farmers who had at least 1 year of farming experience, owned at least 1 dairy cow, and were affected by FMD.

2. 1. Data Analysis Method

2. 1. 1. Quantitative Descriptive Analysis

According to [4], the descriptive method with a quantitative approach is a method that attempts to describe a phenomenon, event, or occurrence that is happening at the present time using numbers, starting from data collection, interpretation of the data, and presentation of the results.

2.1.2. *Multiple Linear Regression Analysis*

Multiple linear regression analysis is a regression analysis involving two or more independent variables with one dependent variable. The independent variables in this study include physiological needs, security needs, social needs, esteem needs, and self-actualization needs. Meanwhile, the dependent variable in this study is the motivation for dairy cattle farming. The model used for multiple regression analysis is as follows:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + e \qquad (1)$$

- Explanation:
Y: Continuity of dairy cattle farming
 β_0 : Constant
 β : Regression coefficient
X1: Physiological needs
X2: Security needs
X3: Social needs
X4: Need for recognition
X5: Self-actualization needs
e: Error

2.1.3. *Statistical Tests*

The further test used in this study is the t-test to see the partial influence of variables. To see the joint influence, the F-test is used, and to see the magnitude of the influence, the R²-test is used.

3 Results and discussion

The Mojosongo subdistrict is administratively part of the Boyolali regency. This area is known as one of the centers of dairy farming with the highest population of dairy cows and adequate local resources, such as feed availability, labor, and fairly good infrastructure. This potential makes dairy farming a business opportunity that can provide economic benefits for the community, especially farmers in rural areas.

3.1 The Characteristic of Respondents

The characteristics of dairy farmer respondents are related to the potential of human resources, which are the main capital in business development. The characteristics of respondents observed include the age of farmers, farming experience, number of family members and education level, as well as the number of livestock owned.

Table 1. Characteristics of Dairy Farmers in Mojosongo Subdistrict, Boyolali Regency.

Characteristics of respondents	Results	Number (people)	Percentage
Age of farmers (years)	<15	0	0
	15-64	46	76.7
	>64	14	23.3
Farming experience (years)	1-10	3	5
	11-20	20	33.3
	>20	37	61.7
Number of family members (persons)	<2	1	1.7
	2-3	32	53.3
	4-5	25	41.7
	>5	2	3.3
Education	No schooling	2	3.3
	Elementary school	10	16.7
	Junior High School	23	38.3
	High School	24	40
	University	1	1.7
Number of livestock (heads)	2-3	20	33.3
	4-5	16	26.7
	6-7	9	15
	>7	15	25

Source: Processed primary data, 2025.

Age greatly affects a person's ability to perform work. There are certain age limits that are classified as productive and non-productive ages. According to [5], the productive age of Indonesians is between 15 and 64 years old. Research data shows that most respondents are within the productive age range. The percentage of respondents of productive age (15-64) reached 76.7%. According to the KBBI (Big Indonesian Dictionary), productive age is the age at which a person is still able to work and produce something. This is in line with the opinion of [6] that people classified as productive are those who are able to carry out their work between the ages of 15 and 60. Farmers of productive age will find it easy to make efficient decisions to solve problems encountered during the maintenance period.

Farming experience from research results shows that the highest percentage of experience is >20 years at 61.7%. [7] argues that older farmers generally have longer farming experience and are also wiser in accepting or adopting cattle farming technology. Farmers with longer experience generally have a more prudent attitude and are more skilled in running their businesses compared to farmers with less experience. Experience is a lesson learned from the daily activities of farmers. Sufficient experience supported by adequate education will make it easier for farmers to develop their dairy cattle businesses.

Table 1 shows that the majority of families have 2-3 members, with a percentage of 53.3%. Family members are people who live under the same roof as the farmer. Generally, family members play a role in running the family business, but not all family members are involved in it. [8] states that the high level of needs that must be met, as seen from the number of family members, will burden the household in meeting their daily needs. The

number of family members can have an impact on the daily needs of farmers; the more family members there are, the more needs must be met from the results of the business they run.

The education level of dairy farmers in Mojosongo Subdistrict is at the high school level, with 24 respondents or 40%. The education level of farmers in Mojosongo Subdistrict is classified as upper secondary education. According to [9], differences in the formal education level of farmers have an influence on their level of competence and way of thinking. [10] states that dairy farmers generally acquire their understanding of farming from their parents. With the level of education that has been achieved, the recurrence of FMD outbreaks should be handled immediately so that action can be taken to prevent transmission to other livestock. The majority of farmers own 2-3 cattle, accounting for 33.3% of the total. Dairy farming in Mojosongo is mostly a small-scale farming business and a side business. According to [11], small-scale farming generally owns between 1-5 cattle.

3.1. **Validity and Reliability Tests**

The validity test is used to measure the ability of questions or statements compiled to measure variables [12]. Meanwhile, the reliability test is used as an index that shows reliability and consistency in research. The results of the validity and reliability tests can be seen in Table 2.

Table 2. Results of validity and reliability tests.

Variable	Questionnai re Items	Validity		Reliability	
		Value	Notes	Cronbach's Alpha	Note
Physiological Needs (X1)	X1.1	0.738	<i>Valid</i>	.638	<i>Reliable</i>
	X1.2	0.592	<i>Valid</i>		
	X1.3	0.822	<i>Valid</i>		
	X1.4	0.636	<i>Valid</i>		
Security needs (X2)	X2.1	0,609	<i>Valid</i>	.605	<i>Reliable</i>
	X2.1	0,609	<i>Valid</i>		
	X2.2	0.521	<i>Valid</i>		
	X2.3	0.693	<i>Valid</i>		
	X2.4	0.692	<i>Valid</i>		
Social needs (X3)	X2.5	0.611	<i>Valid</i>	.783	<i>Reliable</i>
	X3.1	0.709	<i>Valid</i>		
	X3.2	0.873	<i>Valid</i>		
	X3.3	0.895	<i>Valid</i>		
	X3.4	0.588	<i>Valid</i>		
Need for recognition (X4)	X3.5	0.583	<i>Valid</i>	.774	<i>Reliable</i>
	X4.1	0.708	<i>Valid</i>		
	X4.2	0.835	<i>Valid</i>		
	X4.3	0.727	<i>Valid</i>		
self- actualization needs (X5)	X4.4	0.820	<i>Valid</i>	.611	<i>Reliable</i>
	X5.1	0.766	<i>Valid</i>		
	X5.2	0.636	<i>Valid</i>		
	X5.3	0.846	<i>Valid</i>		

Continuity of dairy cattle farmer (Y)	X5.4	0.402	Valid	.696	Reliable
	X5.5	0.406	Valid		
	Y.1	0.787	Valid		
	Y.2	0.679	Valid		
	Y.3	0.680	Valid		
	Y.4	0.769	Valid		

Source: Processed Primary Data, 2025.

The criteria used to evaluate the validity of the tools used in this study were based on the degree of freedom (df) calculated as n-3 (60-3=57) at a significance level of 5%. Based on Table 2, the results of testing all research variables had $r_{(calculated)} > r_{(table)}$ and a $r_{(table)}$ value of $r = 0.254$. The validity test in this study indicates that all questions for the *independent* and *dependent* variables for 60 respondents obtained $r_{(calculated)} > r_{(table)}$, so that all questions analyzed are considered valid or can be used as a means of data collection. Ghozali [13] states that if $r_{(count)}$ exceeds $r_{(table)}$ and the value is positive, then the item or question is declared valid.

The reliability test in this study used the *Cronbach's Alpha* method. The results of the reliability test show reliable results that can be used for data collection, because all questions from 60 respondents obtained *Cronbach's Alpha* results > 0.6 , which can be seen in Table 3. As stated in [14], if the *Cronbach's Alpha* value is > 0.60 , the questionnaire tested is declared reliable. The higher the reliability value of a questionnaire, the more stable the questionnaire is.

3.3. Multiple Linear Regression Analysis Results

Multiple linear regression analysis is used to understand the linear relationship between two or more *independent* variables and one *dependent* variable [13]. In this case, motivation (Y) is the dependent variable, while physiological needs (X1), security needs (X2), social needs (X3), need of recognition (X4), and self-actualization needs (X5) are the independent variables. The results of the multiple linear regression test can be found in Table 3.

Table 3. Results of multiple linear regression test.

Variable	Regression Coefficient	Sig
(Constant)	4.741	0.074
Physiological needs (X1)	-0.070	0.505
Security needs (X2)	0.348	0.002
Social needs (X3)	0.284	0.054
Need for recognition (X4)	0.060	0.685
Self-actualization needs (X5)	-0.044	0.618

Source: Processed Primary Data, 2025.

From the data analysis, the following equation model was obtained:

$$Y = 4.741 - 0.070X1 + 0.348X2 + 0.284X3 + 0.060X4 - 0.044X5 + e \tag{2}$$

The results of multiple linear regression analysis show that the constant value obtained is 4.741 and is positive. This means that if the independent variable value remains constant, the continuity of dairy cattle farming is 4.741. The regression coefficient value of the physiological needs variable (X1) is -0.070, which is negative. This indicates that physiological needs have a negative effect on the continuity of dairy cattle farming, which means that if physiological needs are increased by one unit, the continuity of dairy cattle farming will decrease by 0.070. For the security needs variable (X2), the regression coefficient obtained is 0.348, which means that if security needs increase by 1 unit while other variables remain constant, the continuity of dairy cattle farming will increase by 0.348. For the social needs variable (X3), a regression coefficient of 0.284 was obtained, which means that if social needs increase by one unit while other variables remain constant, motivation for dairy farming will increase by 0.284. For the reward needs variable (X4), a regression coefficient of 0.060 was obtained, which means that if reward needs increase by 1 unit while other variables remain constant, the continuity of dairy farming will increase by 0.060. For the self-actualization needs variable (X5), a regression coefficient of -0.044 was obtained, which means that if self-actualization needs increase by 1 unit while other variables remain constant, the continuity of dairy cattle farming will decrease by 0.044.

3.2. Statistical Analysis

3.2.1. F-Test

The F test is performed by comparing the value of $f_{\text{calculated}}$ with the value of f_{table} . If the value of $f_{\text{calculated}}$ is greater than f_{table} , then it can be said that there is a simultaneous effect of the independent variables on the dependent variable [15]. The results of the F test can be seen in Table 4.

Table 4. F Test Results.

Model		Sum of Squares	Df	Mean Square	F	Sig
1	Regression	39.264	5	7.853	5.917	.000
	Residual	71.670	54	1.327		
	Total	110.933	59			

Source: Processed Primary Data, 2025.

Based on Table 2, the value of $f_{\text{calculated}} = 5.917$ is greater than the value of $f_{\text{table}} = 2.386$ and $\text{sig} = 0.000$, which is below 5% or 0.05. [14] states that if $f_{\text{calculated}} > f_{\text{table}}$, then the null hypothesis is rejected. This indicates that all independent variables have a simultaneous effect or contribute to changes in dairy farmers' motivation.

3.2.2. t-test

The t-test is used to determine whether the independent variables partially influence the dependent variables. The significance level used is 5%. The results of the t-test calculations can be seen in Table 5.

Table 5. T-test Results.

Variable	t _{calculated}	t _{table}	Sig	Note
Physiological needs (X1)	-0.672	1.674	.505	Not significant
Security needs (X2)	3.177		.002	Significant
Social needs (X3)	1.970		.054	Not significant
Need for recognition (X4)	0.408		.685	Not significant
Self-actualization needs (X5)	-0.501		.618	Not Significant

Source: Processed Primary Data, 2025.

The physiological needs variable (X1) in Table 3 has a t-value of -0.672 < 1.674 (Sig = 0.505), which means that the physiological needs variable does not have a significant partial effect on the variable of continuity of dairy cattle farming(Y). This means that basic needs such as food, clothing, and shelter are not the main factors that can increase motivation for dairy cattle farming.

The security needs variable (X2) has a t-value of 3.177 > 1.674, with Sig = 0.002. This means that the security needs variable has a significant effect. These results show that the higher the sense of security, such as cattle recovering from foot-and-mouth disease, price stability, and protection from business risks, the higher the motivation to continue the business.

The social needs variable (X3) has a t-value of 1.970 > 1.674 with Sig = 0.054, which means that this variable has a positive but weak effect on dairy farmers' motivation to continue their business. Social relationships between dairy farmers, cooperation and support between farmers or members of livestock groups still play a role in increasing farmers' motivation, although the influence is not very strong. Dairy farmers interact with each other to establish cooperation and share information, thereby fostering a shared spirit.

The reward need variable (X4) has a t-value of 0.408 (< 1.674) with a Sig value of 0.685, indicating that reward needs do not have a significant effect on motivation in dairy farming. Factors such as recognition, social status, or formal rewards are not yet major factors for dairy farmers. Farmers are more motivated by economic stability and business security, and the absence of dangerous diseases for their livestock.

The self-actualization variable (X5) has a t-value of -0.501 (< 1.674) with a Sig value of 0.618 (>0.05). These results indicate that self-actualization needs do not have a significant effect) on dairy farming motivation. Opportunities for self-development, innovation, or creativity are not yet a priority for farmers. This is most likely because they are still focused on more basic needs such as economic and social security.

The t-test results show that dairy farmers' needs are still at the security stage in Maslow's hierarchy, meaning they are still trying to ensure economic stability and business security before moving on to higher needs such as esteem and self-actualization. Dairy farmers are still traumatized by the ongoing FMD cases.

3. 3.3.. Determination Coefficient Test (R²)

The coefficient of determination (R²) serves to measure the extent to which the independent variables collectively explain the dependent variable. The results of the R² test can be seen in Table 6.

Table 6. Results of the coefficient of determination test.

Model	R	R Square	Adjusted R Square	Std. Error
1	.595 ^a	.354	.294	1.152

Source: Processed Primary Data, 2024.

Based on the table above, *the adjusted R square* has a value of 0.354. The R value reflects the relationship between the *independent* and *dependent* variables. The R value ranges from 0 to 1. If the value is close to 1, this indicates a stronger relationship, whereas if the value is close to 0, this indicates a weaker relationship.

This value means that variable X can explain 35.4% of the variation in the dependent variable, while the remaining 64.68% is influenced by other factors not included in this study [14]. Additional factors that may influence motivation in dairy farming include milk prices, social conditions, and primary occupation.

4 Conclusion

Based on the results of the study conducted, the following conclusions can be drawn:

1. Dairy farmers in Mojosongo sub-district are of productive age with long farming experience and this is the main capital in developing a business.
2. Security needs factor has a significant influence on the continuity of dairy farming businesses, meanwhile physiological needs, social needs, need of recognition, and self-actualization needs do not impact the continuity of dairy cattle farming in Mojosongo District, Boyolali Regency

Acknowledgment

The author would like to thank the Research and Community Service Institute of Sebelas Maret University for the research grant through the Non-State Budget Research Group Grant scheme, 2025, with research assignment agreement number 371/UN27.22/PT.01.03/2025. Thanks are also extended to the Boyolali Regency Livestock and Fisheries Service, Central Java, beef cattle and dairy cattle farmers in Boyolali Regency as research respondents.

References

1. K.S. Suroto, A.T. Murti, Analysis of dairy farm profitability in Malang Regency. *Tarjih Tropical Livestock Journal*. **04**, 115-125 (2024)

2. Central Statistics Agency, Livestock statistics of Boyolali Regency in 2025. Central Statistics Agency Boyolali (2025)

3. P. Purwadi, A.B. Prasetyo, the effect of foot and mouth disease (FMD) on milk production and income of smallholder dairy farmers in Boyolali. *Tropical Animal Science*. **6**, 55-59 (2024)

4. S. Arikunto, Research procedures: a practical approach. Rineka Cipta, Yogyakarta (2013)

5. Ministry of Health of the Republic of Indonesia, Guidelines for the implementation of public health insurance. Jakarta: Ministry of Health (2011)

6. M.A. Otoluwa, A.H. Salendu, A.K. Rintjap, M.T. Massie, Prospects for the development of beef cattle farming in Bolangitang Timur Subdistrict, Bolaang Mongondow Utara Regency. *Journal of Animal Science (Zootek Journal)*. **36**, 191–197 (2016)
7. A.G. Murwanto, Characteristics of farmers and level of technology inputs in beef cattle husbandry in Prafi Valley, Manokwari Regency. *Journal of Tropical Animal and Veterinary Science*. **3**, 8-15 (2018)
8. N. Hanum, The influence of income, number of dependents, and education on the consumption patterns of fishing households in Seuneubok Rambong Village, East Aceh. *Jurnal Samudra Ekonomika*. **2**, 75-84 (2018)
9. I.D. Nurdiansyah, Suherman, and H.D. Putranto, The relationship between farmer characteristics and the scale of dairy cow ownership in Kabawetan Subdistrict, Kepahiang Regency. *Tropical Animal Husbandry Bulletin*. **1**, 64-74 (2020).
<https://doi.org/10.31186/bpt.1.2.64-74>
10. I. Ibrahim, S. Supamri, Z. Zainal, Analysis of factors affecting the income of smallholder beef cattle farmers in Lampasio District, Tolitoli Regency, Central Sulawesi Province. *JSEP (Journal of Social and Agricultural Economics)*. **13**: 307-315 (2020)
11. R.D. Lestari, L.M. Baga, R. Nurmalinga, Competitiveness of beef cattle fattening businesses in Bojonegoro Regency, East Java. *Bulletin of Animal Science*. **41**, 101-112 (2017)
12. F. Yusup, Testing the validity and reliability of quantitative research instruments. *Tarbiyah Journal: Scientific Journal of Education*. **7**, 17-23 (2018).
<https://doi.org/10.18592/tarbiyah.v7i1.2100>
13. I. Ghozali, Application of multivariate analysis with the SPSS program. Diponegoro University. Semarang (2016)
14. Herispon, Statistical package for the social sciences (SPSS) module: guide to research data processing using SPSS 23 for students. Pekanbaru: Riau College of Economics (2020)
15. S. Aprilyanti, the influence of age and work experience on work productivity (case study: PT. OASIS Water International Palembang Branch). *Journal of Industrial Systems and Management*. **1**, pp. 68-72 (2017).
<https://doi.org/10.30656/jsmi.v1i2.413>